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SAVANNAH RIVER NATIONAL LABORATORY

# techbriefs

## SonoBeamer™ Device



Scientists at Washington Savannah River Company (WSRC) have demonstrated a new concept of a “sound laser” by creating a highly concentrated beam of ultrasonic waves. The SonoBeamer device concentrates acoustic energy and emits it as a narrow beam of single frequency sound waves.

### **A focused beam of amplified, coherent sound waves**

In recent years, theoretical attention has been paid to the physics of sound amplification by stimulated emission of radiation (SASER). The SASER is the sound analog of a free electron laser, the concept being that the propagation of a sound beam inside a resonant chamber can be constrained to produce a coherent beam of sound waves. The SonoBeamer device is the first known demonstration of the SASER principle.

At the Savannah River Site in Aiken, S.C., solidified residues in aging high-level waste storage tanks need to be dissolved before the tanks can be taken out of commission. The SonoBeamer device was originally conceived to break up these so-called “clinkers,” or “heels.”

The SonoBeamer™ concept is not unlike the well-known use of ultrasonics to break up kidney stones. In this medical application, negative pressure pulses, inducing cavitation, provide the mechanism for breaking kidney stones up in small particles.

### **Current ultrasonic methods are limited**

Current uses of ultrasound to break up, or separate, constituents within a container require the acoustic waves to be propagated throughout the entire container. The generation of omnidirectional radial waves uselessly dissipates energy. This method is limited to relatively small containers, as its use in larger volumes would require prohibitive amounts of energy.

Also, ordinary flat plate ultrasonic transducers are limited to an energy density of a few watts/cm<sup>2</sup>. The SonoBeamer has the potential for increasing this by an order of magnitude or more.

### **at a glance**

- designed for large volume use
- channels acoustic energy
- increases energy density
- emits directional sound waves
- u.s. patent 6,489,707

## **SonoBeamer is highly directional**

The SonoBeamer is capable of emitting concentrated pressure waves at a single frequency, providing an efficient means of projecting directional sound waves into and through a medium. The directed beam can induce cavitation within a medium along a specified path or at a specific location.

## **Entire device can be immersed**

The SonoBeamer comprises a tube enclosed in a housing with one end open and the other end closed by an acoustically reflective wall. The tube is filled with an active medium. The housing is designed to be totally immersed in any medium through which acoustic energy is to be transmitted. If the active medium inside the tube needs to be different than the surrounding medium, the open end of the tube can be covered with a thin, acoustically transparent diaphragm.

## **Transducer oscillates radially**

The tube, or transducer, is constructed to resonate at a desired frequency. A power source supplies a tuned, high frequency current through wires connected to the inner and outer surfaces of the tube. The current causes the tube to oscillate in a radial direction. This oscillation creates pressure waves in the active medium that propagate toward and away from the center of the tube.

## **Technology transfer**

SRNL is the applied research and development laboratory at the Savannah River Site (SRS). With its wide spectrum of expertise in areas such as homeland security, hydrogen technology, materials, sensors, and environmental science, SRNL's cutting edge technology delivers high dividends to its customers.

SRNL and SRS are managed for the U.S. Department of Energy by Washington Savannah River Company (WSRC). WSRC is responsible for transferring technologies to the private sector so that these technologies may have the collateral benefit of enhancing U.S. economic competitiveness.

## **Partnering opportunity**

Patent 6,489,707 has been issued by the U.S. Patent and Trademark Office for the SonoBeamer. The SonoBeamer should prove to be an effective device for sonochemistry applications, for cleaning of underwater structures, and for underwater communications.

WSRC invites interested companies with proven capabilities in this area of expertise to enter into a licensing agreement with WSRC to manufacture and market this device as a commercial product. Interested companies will be requested to submit a business plan setting forth company qualifications, strategies, activities, and milestones for commercializing this invention. Qualifications should include past experience at bringing similar products to market, reasonable schedule for product launch, sufficient manufacturing capacity, established distribution networks, and evidence of sufficient financial resources for product development and launch.

## **for more information**

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